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purpose of imparting to the student a clear understanding of the salient principles of geodesy and of the points of contact between this science and the sciences of geology, meteorology, and physical geography. The discussions of the form and size of the earth, and of its mass and motions, are well presented, and geodetic astronomy is treated to an extent sufficient to round out the whole subject with completeness. The interest and value attached to the treatise are enhanced by a final chapter setting forth the most recent views, based on the most exact levelling operations and measurements of attraction, concerning the deformations of the terrestrial geoid from an exact figure of revolution. Careful investigations show that there is a decided tendency for the deflections of the plumb line to be in such a direction as to indicate that they are due to a defect in the mass of the oceans or an excess of mass in the continents, or to both, and that regional deflections common to considerable areas are due to the general or large features of the topography; and it has become evident that to make true progress in the study of the figure of the earth the relation between the deflections of the vertical and the general features of the surface forms must receive close attention. G. W. L.

A Critical Study of the Various Dates Assigned to the Birth of Christopher Columbus. The Real Date 1451. With a Bibliography of the Question. By Henry Vignaud, First Secretary of the Embassy of the United States in Paris, Author of "Toscanelli and Columbus," etc., etc., etc. London, Henry Stevens, Son & Stiles, 39 Great Russell Street, over against the South-West Corner of the British Museum, 1903.

Mr. Vignaud has studied the information obtainable from the assertions of Columbus, from the testimony of his contemporaries, and from the documents of Italian notaries, in which mention is made of Columbus or members of his family; and he arrives at the conclusion that the Discoverer was born in 1451. The document which justifies this conclusion is one drafted at Genoa the 31st of October, 1470, by the notary, L. Raggio, wherein Columbus (then present with his father) is described as the son of Domenico, and nineteen years old.

Mr. Vignaud's argument that this date of 1451 fits in with the well-known facts in the life of Columbus is entirely sound.

He gives the credit for the first recognition of the date to Mr. Richard Davey, author of an article on *The Boyhood and Youth of Columbus* (The National Review, October, 1892).

In his Introduction Mr. Vignaud says that the necessary texts will be found in his book. The first text given (on p. 2) is from the Journal of Columbus, Dec. 21, 1492, in these words:

> Yo he andado veinte y tres años en la mar, sin salir della tiempo que se haya de contar.—(I have followed the sea for twenty-three years, without leaving it for any length of time.)

Mr. Vignaud makes Columbus declare *That he has overrun the world during 23 years almost without interruption;* a translation which does not even suggest the original. The words might be put in the mouth of Jenghiz Khan.

It is unfortunate that errors in the Bibliography have escaped the proof-reader. On p. 110 *Navarette* occurs twice, and a few lines below *scopitore*, *Rosseuw* St. Hilaire on p. 113, *Cantu* on p. 115, *Guinguéné* on p. 116, and *Munoz* on p. 117.

THE DESERTS OF THE UNITED STATES.—The *Desert Botanical Laboratory of the Carnegie Institution* (Carnegie Institution of Washington, Publication No. 6, November, 1903. By F. V. Coville and D. T. MacDougal) promises to give us some valuable contributions to our knowledge of the desert meteorology of North America, as well as to those fields of investigation which lie along the borderline between meteorology and botany. The Laboratory was established at the suggestion of Mr. F. V. Coville, botanist of the United States Department of Agriculture, "the purpose of such establishment being to thoroughly study the relation of plants to an arid climate and to substrata of unusual composition." The site selected is near Tucson, Arizona; a suitable structure has been erected, and investigations commenced in the autumn of 1903. Mr. Coville and Dr. MacDougal acted as a committee of inquiry in determining the best location for the Laboratory, and the present publication gives a brief narrative of their trip and of the desert flora met with in different districts. Numerous excellent illustrations of landscapes showing characteristic vegetation are included. Among the localities visited were the arid region of western Texas, the sand dunes of Chihuahua, the Tularosa Desert, Nogales, Torres, Guaymas, the Colorado Desert, the Mohave Desert, and the Grand Cañon of the Colorado, the vicinity of Tucson being finally selected as the best site for the Laboratory.

Among the various reasons determining the selection of Tucson was the fact that this place has a climate of a thoroughly desert character, and is centrally and conveniently located. In addition to the natural desert flora, which is rich and varied, there is a great variety of annual vegetation which springs up after a rain, especially after the repeated rains of the winter. Rain in these deserts is so important in its effects upon the rapid growth of vegetation that, as has been noted by McGee, the Papago Indians

> chased rain storms seen from commanding peaks for scores, if not hundreds of miles; and wherever they found standing or running water or even damp soil, they planted their seeds,

and so scarce is water that these same Indians often cut off the top of a bisnaga, or barrel cactus, pound the white flesh in the standing trunk to a pulp, and then squeeze the water out of this pulp. Plate XVIII shows a Papago Indian drinking water obtained from a cactus in this way, two or three quarts of clear water having been secured from one plant. This water was

> slightly salty and slightly bitter to the taste, but of far better quality than some of the water a desert traveler is occasionally compelled to use.

Exception is taken by the authors to the usual definition of a desert as

> "a region of considerable extent, almost, if not quite destitute of vegetation,"

and the word is applied to areas

> which support a sparse vegetation of a more or less specialized character owing to inadequate rainfall, or to the unsuitable composition or lack of soil.

A scanty water supply is the factor of greatest importance, and most deserts owe their existence to this control, but the authors are rightly careful to say that no arbitrary amount of rainfall can be named as being an invariable cause or accompaniment of desert conditions. The reason for this is to be found in the fact that the seasonal distribution of the rainfall is of very great importance in any region; for if the rain comes in a brief season, the rest of the year may be dry, and desert conditions may prevail. In certain parts of the tropics, for example, aridity prevails where there are 70 inches of rainfall.

The North American deserts are confined to the region of the Cordillera, occupying plateaux and plains both east and west of the main ranges, and extending over more than a million square miles. On page 28, Fig. 1, a map is given showing the location of, and the annual precipitation at, certain stations in the arid region of western America, and if these stations are connected by enclosing lines, the outlines of the great desert areas of the continent can easily be seen. These areas are two in number, and may be designated as the Sonora-Nevada desert (embracing portions of Utah, Idaho, Washington, Oregon, Nevada, California, Arizona, Lower California, Sonora, and Sinaloa), and the Chihuahua desert, which, occupying the central Mexican table-land east of the Sierra Madre, extends as far south as San Luis Potosi, and includes parts of Texas, Arizona, and New Mexico, while the Bad Lands of the Dakotas and Montana and the Red Desert of Wyoming are to be regarded, for the purposes of the present Report, as a northern arm of the same region. Several tables of temperature and rainfall at a number of stations in these desert areas are given (pp. 25-27), but there is obviously a great uncertainty regarding the amount of annual evaporation (p. 27), concerning which we at present have practically no reliable information. Rough estimates of the evaporation show that at Tucson and at Laramie it is about seven times as great as the normal precipitation; while at Yuma, Arizona, it is more than thirty-five times as great.

Among the many facts of interest in this Report mention may be made of the temperatures recorded around the root tips of bunch grass at a depth of two inches. At 2.20 P.M., on July 16, 106° was recorded, and a few minutes later 108°, the air temperature being 91° to 93°. At 3 P.M. black volcanic sand around the roots of *Cleome serrulata* Pursh showed a temperature of 111°. The temperature of the soil at a depth of 1 inch near Tucson has a mean for July of 104.9° (Toumey), and around the roots of small herbaceous plants in the Grand Cañon, Arizona, the sandy soil showed temperatures of 148° on September 4, 1898 (Douglass). Thermometers whose bulbs were inserted into the stems of fleshy plants such as *Cereus* often showed temperatures of 113° to 115°, with air temperatures of 93° to 100°. The critical point of chlorophyl is usually given as 113°. Hence it is suggested that

> the protoplasm of plants which have become adapted to this region must have undergone certain variations in composition, as its maximum point of activity is beyond that of other plants, and these forms must also be furnished with specially adapted chloroplasts, by which the chlorophyl would be kept from injury at temperatures beyond the critical point at which it suffers damage in other plants.

Some comparative observations upon the climatic features encountered by Alpine plants were made on San Francisco Mountain in August, 1898, by Messrs. MacDougal, and are referred to in this Report. These observations showed the usual mountain conditions of a smaller diurnal variation of temperature, and of greater differences between the temperatures of the air and of the soil than at lower levels. At 4 P.M., August 8, on the western slope of the peak, the soil had a temperature of 71.6°, and the air 57.6°; at 7 A.M. the next morning the minimum of 21.2° was obtained for the air, and 48.2° for the soil.

An interesting effect of wind-driven sand is noted (p. 22) as having been observed between Rimlon and Palm Springs, Cal. Here the sand-laden winds constitute a veritable sand blast. The western faces of the telegraph poles are deeply cut within two feet of the ground by the driven sand, and the employés of the railroad have found it necessary to pile up stones around the base of the poles to prevent their being cut off. A creosote bush in the lee of a small boulder had all its twigs which projected beyond the protection of the boulder killed by the sand blast, and the plant resembled a miniature box hedge about a foot and half wide, extending about four feet from the rock. R. DeC. W.

Aperçu des Résultats météorologiques de l'Hivernage antarctique de la "Belgica." Par Henryk Arctowski. 12mo. Bruxelles, 1904. pp. 41.

The meteorological results obtained on the *Belgica* expedition have already been discussed in more or less detail by M. Arctowski in various papers published in *Ciel et Terre* soon after the return of the expedition, and have been referred to in the BULLETIN. The present little volume, which is reprinted from the *Annuaire météorologique* of the Royal Observatory of Belgium for 1904, is the official summary of the results, which are presented in compact form, but with little discussion. The meteorological journal of the expedition, which has not yet been published, will, together with the papers already printed and the present report, give a complete survey of the meteorological work of the *Belgica* expedition.

R. DeC. W.

The Mystic Mid-region; the Deserts of the Southwest. By Arthur J. Burdick. With 54 illustrations. New York, G. P. Putnam's Sons, 1904. 8vo.

The region here described is from two hundred to five hundred miles wide, and from seven hundred to eight hundred miles long, and it extends fard own into Mexico. It lies largely in eastern California, in Nevada, and in the extreme western portion of Arizona.

While this country is in many respects a formidable waste, there is much that is attractive in connection with it.

The narrow and restricted lives of the desert Indian tribes—the Panamints in the north, the Mojaves in the Mojave Desert, the Yumas lower down, and the Cocopas and the Seris in the